Space Weather Technical Forecast

Issued on Saturday 19 October 2024 at 13:26 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Further M-flares likely, mainly day 1-2 (19-20 Oct). Chance of G1 Minor Storm intervals, mainly days 3-4 (21-22 Oct).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with four M-class flares, all from AR3854, peaking with an M6.5 at 18/0656 UTC. This region is difficult to observe, with its leader now moving onto the far-side, however some significant magnetic looping remains evident over the west limb. Including this region, there are eight sunspot groups on the disc, however the other regions are relatively simple and stable. The main other exception is perhaps AR3863 near the east limb, with some small spots becoming evident around its leader as it moves into a clearer view, however this currently remains inactive.

No Earth-directed CMEs were observed, with the CME from the M6.5 flare expected to be missing and passing well ahead of Earth

Solar Wind / Geomagnetic Activity: A weak enhancement in the solar wind was likely due to interactions with a CIR region on the southern edge of CH80/+. Solar winds speeds, as observed at L1 by ACE increased from background to slightly elevated, 350 km/s to around 400-450km/s. Density was around or below average. Interplanetary Magnetic Field (IMF), Bt, was Moderate at first 7-10nT but eased to Weak 5-8nT by 19/0600 UTC. The north-south component, Bz, was turbulent and occasionally Moderate, but favoured a negative (southward) orientation for much of the period. This ranged between -10 to +9 nT. Phi angle was generally positive (away from the Sun), but did show brief rotations to negative (towards the Sun). Geomagnetic activity was Unsettled to Active (Kp3-4), with one period of G1 Minor Storm (19/0000-0300UTC).

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 was at background. High energy electron flux (greater than 2MeV) observed by GOES16 saw a diurnal rise from Background to High, peaking at 1180 pfu at 18/1635 UTC, but then fell back to be Background from 18/1830 UTC. The associated 24-hour fluence was below the Active threshold. The 19/0000 UTC observation was 1.26e7 total pfu.

Four-Day Space Weather Forecast Summary

Solar Activity: Moderate activity is forecast with isolated M-class flares likely. These most likely on day 1-2 (19-20 Oct) from AR3863 as it recedes onto the far-side.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

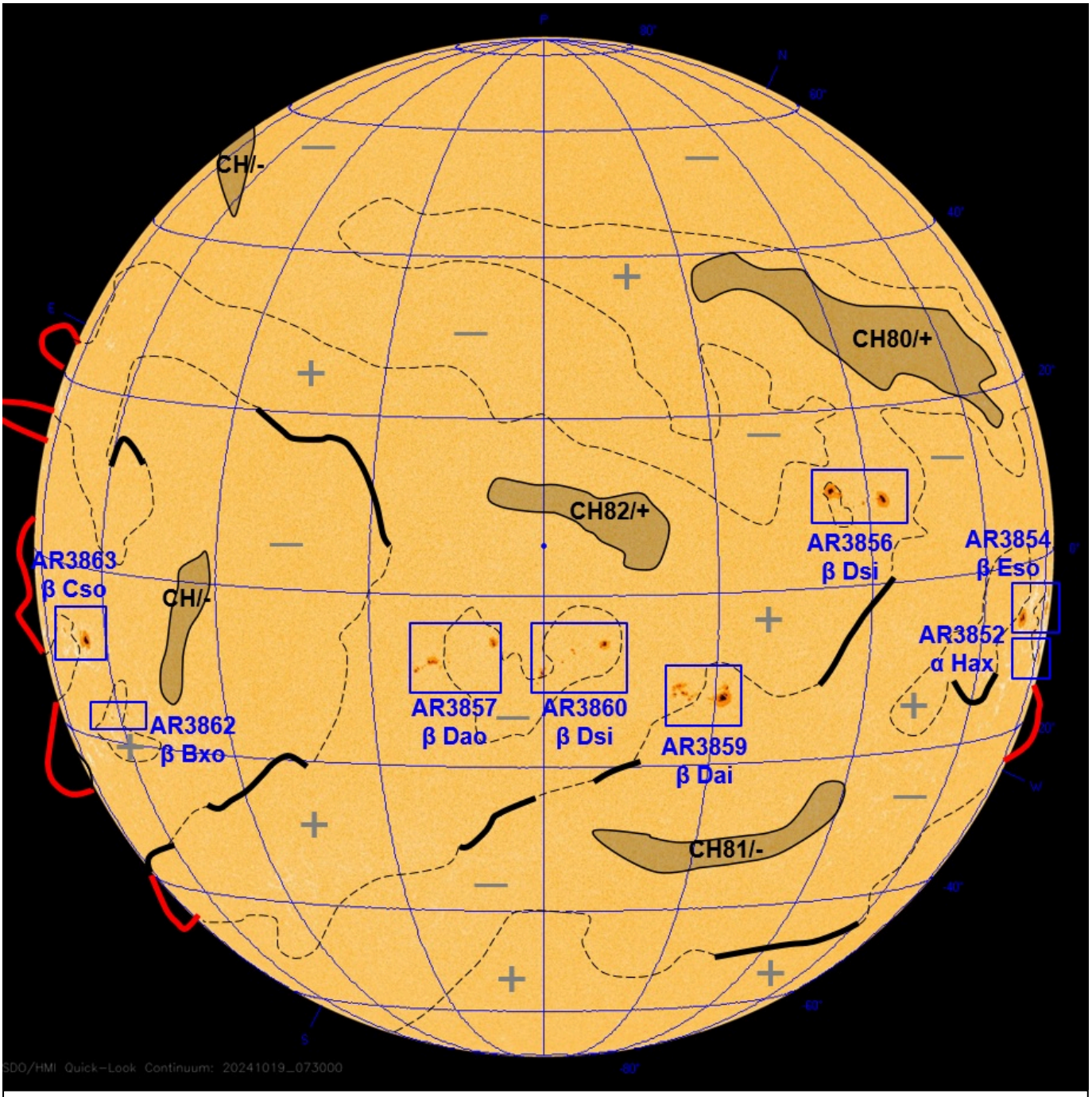
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Further spells of slightly elevated to elevated winds remain possible from any further interactions with the fast wind from CH80/+, which is likely passing north of Earth during days 1-2 (19-20 Oct). CH82/+ fast winds are then possible late day 3 (21 Oct) and into Day 4 (22 Oct) Mainly Quiet to Unsettled geomagnetic activity is forecast, but with a chance of isolated Active to G1 Minor Storm intervals from any further enhancement from CH80 days 1-2 (19-20 Oct), then increasing to Unsettled to Active with G1 Minor Storm intervals likely, late day 3 or day 4 (21-22 Oct).

Energetic Particles / Solar Radiation: High energy proton flux at GOES18 is expected to remain at background. High energy electron flux at GOES-16 is forecast to remain mainly Low with the associated 24 hour fluence is expected to remain below Active (1e8 total pfu).

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 1: Solar Synoptic Map 19/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Geomagnetic Storms

There are no Earth-directed CMEs.

Solar winds are currently slightly elevated perhaps due to some weak interaction with either CH80/+, its surrounding CIR region or other weak transients. CH80/+ is a large coronal hole in the northwest, and while the core of the fast wind is likely passing north of Earth, ongoing interactions with the southern edge of the winds are possible given Earth's current location north of the elliptic plane. This could give further spells of slightly elevated to elevated winds of around 450-500km/s through days 1-2 (19-20 Oct).

The next enhancement will then be from the onset of fast winds from CH82/+ This is a smaller feature, but due to its more equatorial location has a greater chance of connection, with the likely arrival for any CIR region expected to occur either late on day 3 or day 4 (21-22 Oct). A period of elevated solar winds is then expected to follow, and given G1 Minor Storm intervals were observed on the previous rotation from this feature, similar can be expected on this occasion. MOSWOC Enlil does show a weak enhancement possibly from this feature, however this is later that currently anticipated given the coronal holes location

Geomagnetic activity is forecast to be mainly Quiet to Unsettled, but with a chance of isolated Active to G1 Minor Storm intervals from any further enhancement from CH80 days 1-2 (19-20 Oct). Fast wind onset from CH82 is then expected to bring Active to G1 Minor Storm intervals, perhaps on day 3 (21 Oct), but more likely on day 4 (22 Oct).

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	**G1 to G2**	Yes	30	10	20	50
Strong	**G3**	No	1	1	1	1
Severe	**G4**	No	1	1	1	1
Extreme	**G5**	No	1	1	1	1

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Figure 2: BGS Geomagnetic Activity

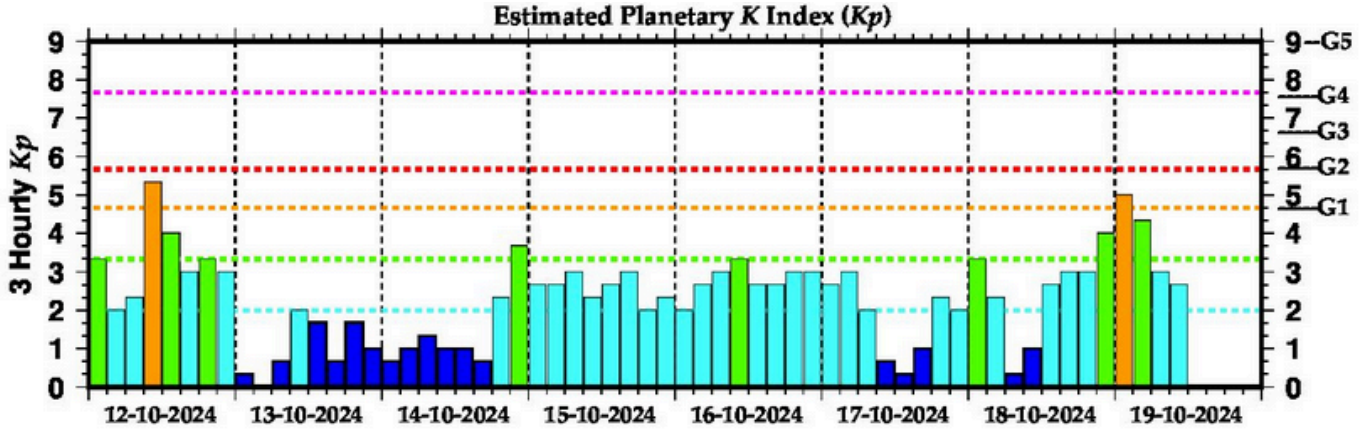
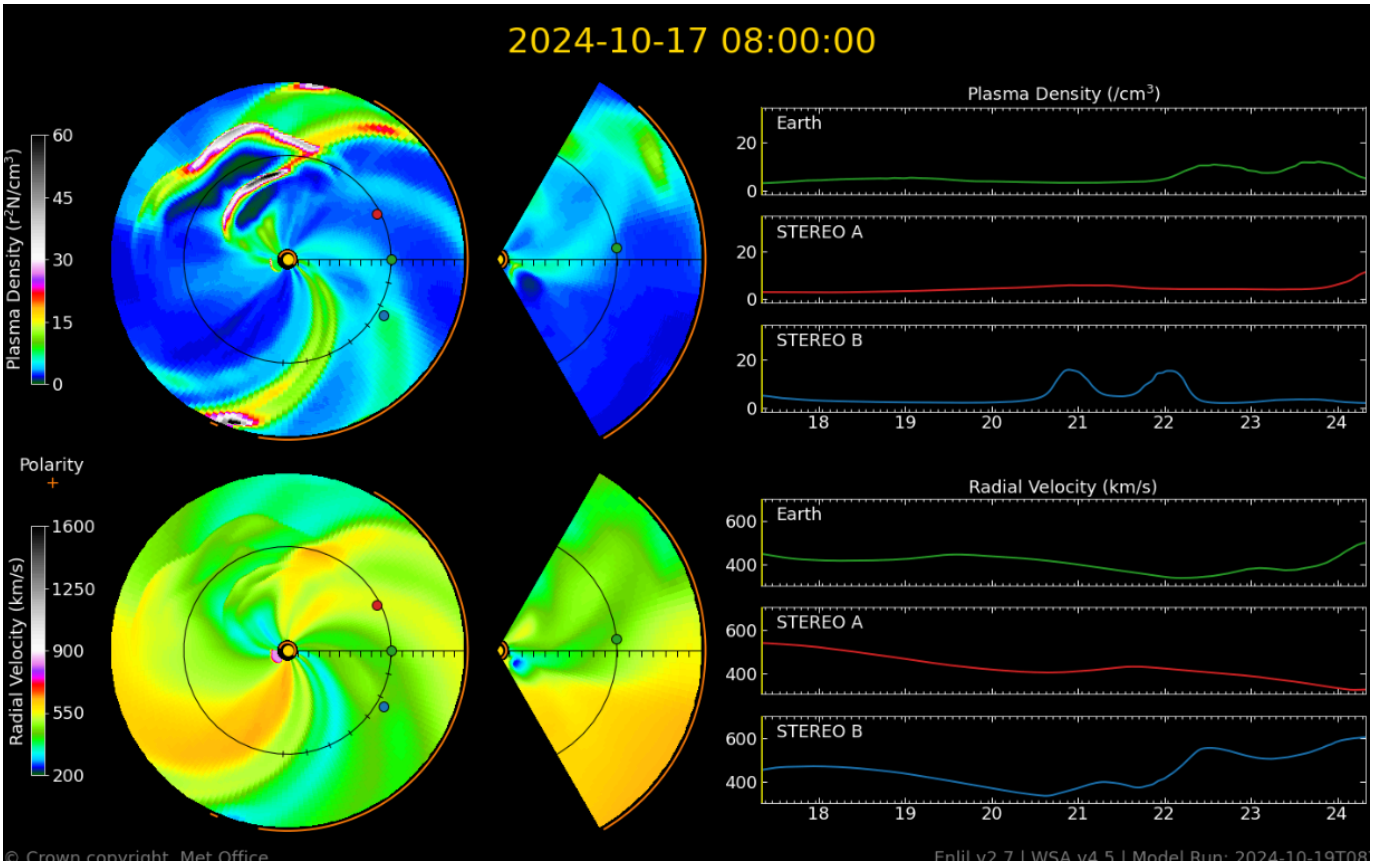


Figure 3: MOSWOC Enlil. Enhancement indicated on 23-24 Oct is likely the late onset of the expected central disc coronal hole enhancement 21-22 Oct.



© Crown Copyright 2024. All Rights Reserved.

Radio Blackouts - X-Ray Flares

Solar activity is forecast to be Moderate at first with further M-class flares likely on day 1-2 (19-20 Oct), then becoming Low to Moderate thereafter. This is due to the ongoing activity from vicinity of the leader of AR3854. While this region is now on the west limb and hard to assess, bright magnetic looping is evident in SDO aia-imagery, and the recent M-flares suggests an ongoing potential for further activity as this recedes onto the far-side. This includes the slight chance for an isolated X-class flare.

Including AR3854, there are eight sunspot containing active regions on the Earth-facing disc, however these appear relatively small and simple, with little ongoing growth. The only notable developments have been the recent emergence of small intermediate spots in AR3859 in the southwest, and perhaps some increase in small spots within the nearby plage of AR3863 close to the east limb. However this could be due to the gradually improving viewing angle.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	70	70	60	60
Very Active	R3-R5 (X Class)	No	10	10	5	5

Figure 4: GOES 16-18 X-ray Irradiance. Multiple M-flares from AR3854

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

Solar Radiation Storms (High Energy Protons)

High energy proton flux at GOES18 is expected to remain at background. There is a slight chance of enhancement on day 1-2 (19-20 Oct), due to the recent activity of AR3854 as it moves over the southwest limb, should any more significant flares occur. Otherwise, there is only a very slight chance of enhancement with limited flare activity from the other regions currently on the disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	15	10	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 370 900 0100 Email: enquiries@metoffice.gov.uk

© Crown Copyright 2024. All Rights Reserved.

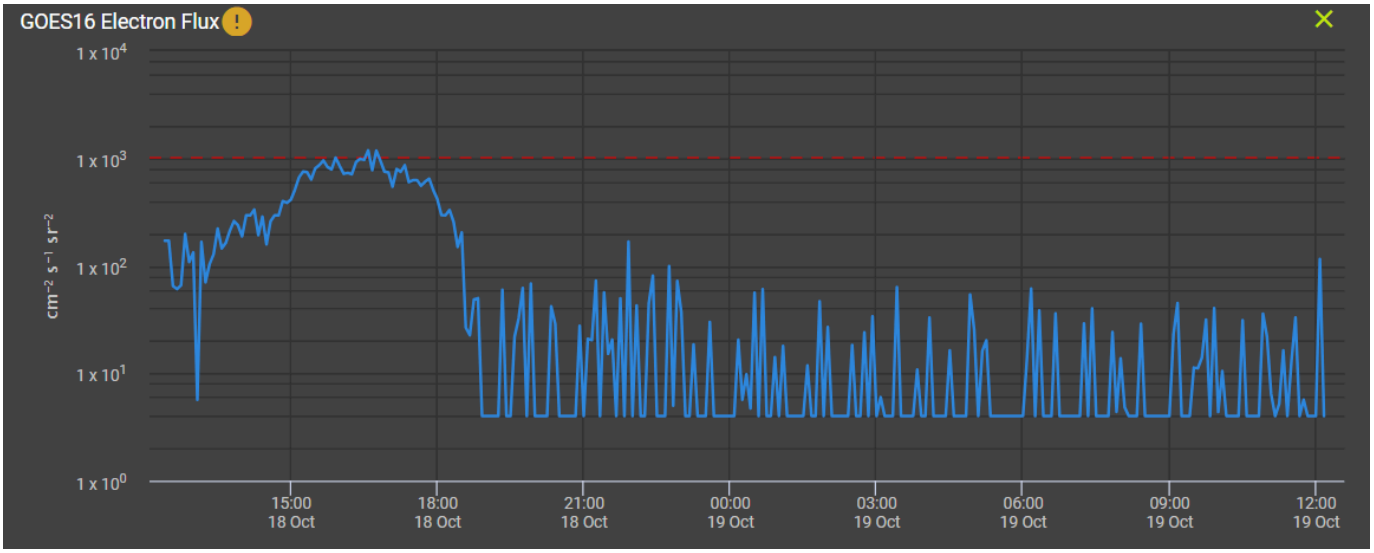
High Energy Electrons (≥ 2MeV)

High energy electron flux (greater than 2MeV) as observed by GOES-16 have been Background to Moderate. These flux values are expected to continue, perhaps becoming more persistently background after the recent weak solar wind enhancement, or any further coronal hole fast wind interaction on days 1-2 (19-20 Oct). Onset of fast winds from central disc CH82 is also likely to suppress values, but with a chance of rising to Moderate later on day 4 (22 Oct) should an early connection to this feature occur

The associated 24 hour fluence is expected to remain below Active with MOSWOC REFM currently providing good guidance.

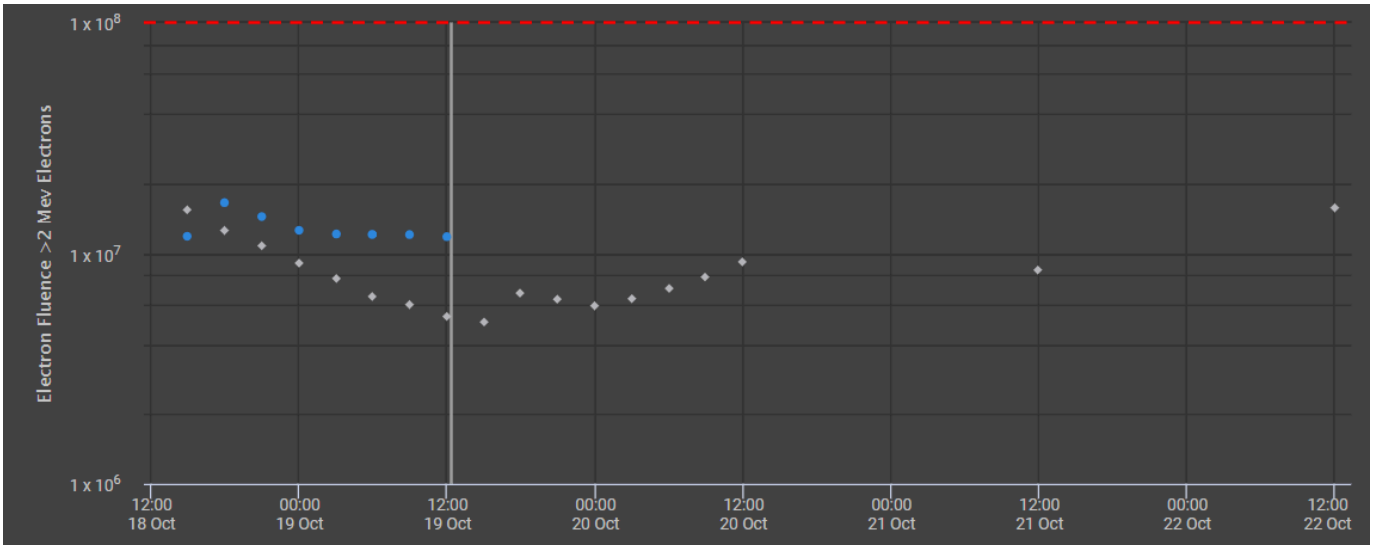
GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	1	1
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 5: GOES 16 High energy Electron Flux



© Crown Copyright 2024. All Rights Reserved.

Figure 6: GOES-16 24 hr High energy Electron Fluence with REFM



© Crown Copyright 2024. All Rights Reserved.